development of bacteria in tubes charged with the filtered liquids after several days is explained by the intentionally imperfect sealing (tubes 33 and 34.) The microscopic examinations of the filtered liquids discovered no bacteria in the case of one of the liquids, and a few non-motile apparently lifeless ones in the case of the other (Mr. Stevens's examination). The presence of penicillium in the tubes is to be explained by anevident abundance of floating spores in the laboratory. These spores must have been so abundant that in the short time the cotton plugs and covers were removed from the tubes to allow inoculation, one of the tubes was infected (see tube 4), and, more wonderful still, one of the flasks, while its tip was broken, managed to receive one or more of the spores into its depths. (See turnip flask in beaker 31.) It is possible that the spore or spores had fallen through the small mouth of the filter and into the filtered liquid, and thence been conveyed to the tube and flask; or that the pipette used, though well flamed, may have been the agent of introduction. The penicillium appearing in tubes 9 and 14 was undoubtedly introduced with the unfiltered turnip infusion, as this infusion had been more or less exposed to the spore-laden atmosphere of the laboratory. However, the experimenters congratulate themselves on the evident success of the sterilization of the culture tubes and flasks. That the mould spores came from the atmosphere rather than from the cotton used in sealing the tubes, is shown by the immediate appearance of penicillium in those tubes left exposed. (See tubes 25, 26 and 27.) In addition to the tests of the filter, observations on the effectiveness of certain methods of handling culture tubes were made, which need not be referred to here.

FIRST ADDITION TO THE LIST OF KANSAS PERONOSPORACEAE.

BY W. T. SWINGLE, B. SC., MANHATTAN, KANSAS.

I published in vol. XI of these Transactions (pp. 63–87) "A List of the Kansas Species of Peronosporaceæ" including the species found within the State up to October, 1889. The paper was also reprinted with the original pagination, and distributed November 1, 1889. I have now a few corrections and additions to report in the list. The additions to the list are arranged as in the original list, and include all specimens collected from October, 1889, to November 1, 1890, and also a few collected before this which were omitted from the original list.

All new localities, host plants, or species new to the State, finding of oospores on hosts where not previously reported, and collection of conidia or oospores in a new month, are shown by the words indicating the fact being printed in **BLACK-FACED** type.

All of the numbers listed here are in my herbarium and also in that of Prof. W. A. Kellerman:

CORRECTIONS IN THE ORIGINAL LIST.

Page 64, line 6 from top, for Schlesеins read Schlesiens.
" " " 29 " " strike out *and* and add after *Hedeomae and P. candida.*
" 66 " 20 " " for Leveille read Léveillé.
" " " 11 " bottom, strike out *with immature oospores.*
" " " 4 " " " " *with very young oospores.*
" 67 " 12 " top, after 1538 add *with nearly mature oospores.*
" " " 21 " " " on, add *stems and.*
" " " 22 " " " 293 strike out *with young oospores.*
" " " 24 " " " on, add *stems and.*

Page 68, line 24 from top, for Lev. read Lév.
" " " 5 " bottom, after 158, insert *with mature oospores.*
" 70 " 4 " top, after SCLEROSPORA strike out Schroeter, in Cohn Krypt. Flora Schles., III Band, S. 236, and insert instead (Schroeter) de Bary, Zur kenntniss der Peronosporeen, in Botanische Zeitung, XXXIX Jahrg., Nr. 39, 30. September, 1881, S. 621.
" 73 " 17 " bottom, insert before 1641, M. A. Carleton No. 163, June 19, 1886, Cloud county; and strike out the same entry from under *Ambrosia trifida* L., p. 73, lines 10 and 9 from bottom.
" 75 " 5 " " before Jahrg. insert III, and for p. 251 read p. 231 Nr. 21.
" 76 " 6 " " after 80, insert, *with mature oospores.*
" " " 5 " " " 80*b*, insert, *with immature oospores.*
" 79 " 25 " top, for *Major* L. read *Rugelii* Decaisne.
" 80 " 7 " bottom, for Anaggallis read Anagallis.
" " " 2 " " " Anagalis read Anagallis.
" 83 " 21 " top, " EFFUSA read EFFUSA.
" 84 " 7 " bottom, " SORDIDA read SORDIDA.

ADDITIONS TO THE ORIGINAL LIST.

PERONOSPORACEAE DE BARY.

1. Cystopus candidus (Pers.) Lév.

On *Sisymbrium canescens* Nutt.

1961, on leaves, March 24, 1890, Manhattan; 1962, on leaves, April 4, 1890, Manhattan; 1963, on leaves, April 28, 1890, Manhattan; 1964, on leaves, with abundant mature oospores in slightly swollen stems, May, 1890 (?). The date of collection of these valuable oospore-bearing specimens is unfortunately somewhat uncertain. The oospores agree very closely with the description and figures given by de Bary Rech. sur le développment de quelques champ. parasites, in An. Sci. Nat., série 4 t. XX, p. 131 (p. 126 of the reprint), Pl. 2, fig. 2–12.

On *Capsella Bursa-pastoris* Moench.

1965, collected by M. Varney, on leaves and stems, with abundant mature oospores in the swollen ends of the stems, and in distorted flowers, June, 1890, Manhattan.

On *Brassica nigra* Koch.

1956, with oospores in swollen stems, petioles and flowers, no conidia, July 7, 1890, Manhattan; 1957, with oospores only in swollen stems and flowers, July 31, 1890, Manhattan. This species was fully as abundant as in 1889, and likewise only oospores could be found when the specimens were collected. The oospores do not agree with the description and figures usually given of *Cystopus candidus*, being often more like those of a *Peronospora* of the *effusa* type. A few were furnished with a very finely warted epispore, but none were seen with the characteristic coarse warts found in typical specimens. It may be that the oospores, from being so crowded in the tissues of the parts attacked, stunted each other, since the host-plants themselves were much injured by drouth. The specimens collected July 4, 1887, (see list, p. 67,) had oospores showing the usual markings.

On *Lepidium intermedium* Gr.

1958, on leaves, April 4, 1890, Manhattan; 1959, on leaves, April 28, 1890, Manhattan; 1960, on leaves, May 8, 1890, Manhattan; 1998, on leaves of seedling plants, OCTOBER 19, 1890, Manhattan.

2. **Cystopus Ipomoeae-panduranae** (S.) Stevenson & Swingle.

On *Ipomoea hederacea* Jacq.

1966, on leaves, August 20, 1890, Manhattan.

In Seymour and Earle, Economic Fungi Fascicle I., January 1, 1890, No. 47, this species is given as *Cystopus Ipomoeae-panduranae* (S.) Farl. Farlow and Seymour, in their Provisional Host-Index of the Fungi of the United States, Part II., September, 1890, pp. 81 and 82, also give the name in this manner. Although Prof. Farlow said in August, 1889,[1] "Undoubtedly the first name given to the form on *Convolvulaceae* in North America was *Æcidium Ipomoeae-panduranae*," yet he nowhere actually called the species *Cystopus Ipomoeae-panduranae*. This was first done by Mr. W. C. Stevenson, jr., and myself in my list (p. 67, No. 2), which was published November 1, 1889; so the name should be given *Cystopus Ipomoeae-panduranae* (S.) Stevenson et Swingle.

3. **Cystopus Portulacae** (DC.) Lév.

On *Portulaca oleracea* L.

1967, July 12, 1890, Manhattan; Mr. E. Bartholomew, No. 236, on leaves, July 15, 1888, Rockport, Rooks county; 1970, coll. W. T. Allen, on leaves, August 13, 1890, Manhattan; 1968, with abundant mature oospores, on leaves, August 20, 1890, Manhattan; 1969, with abundant mature oospores, on leaves, August 20, 1890, Zeandale, Riley county.

In No. 1967 the abundant growth of mycelium caused the affected branches to assume an upright habit of growth like *Euphorbia maculata* L., when attacked by *Æcidium Euphorbiae* Persoon.

5. **Cystopus Amaranti** (S.) Berkeley.

On *Amarantus retroflexus* L.

1950, June 2, 1890, Manhattan; (the first specimen found; it was very rare); 1951, with mature oospores, on leaves, June 14, 1890, Manhattan (abundant); 1952, coll. M. Varney, July 15, 1890, Manhattan.

On **ACNIDA TUBERCULATA** Moq.

1953, coll. M. Varney, on leaves, July 5, 1890, Manhattan; 1954, coll. M. Varney, with mature oospores, on leaves, July 15, 1890, Manhattan; 1955, on leaves, August 20, 1890, Manhattan.

Cystopus Amaranti is more rare on this host at Manhattan than on either *Amarantus albus* or *A. blitoides*. It is very common on *Amarantus retroflexus*.

10. **Plasmopara Halstedii** (Farlow) Berlese & DeToni.

On *Ambrosia psilostachya* DC.

E. Bartholomew No. 348, July 27, 1889, Rockport, Rooks county.

On *Helianthus grosse-serratus* Martens.

1997, May 21, 1890, Manhattan.

On **BIDENS CHRYSANTHEMOIDES** Mich.

1996, June 3, 1890, Manhattan.

[1] Farlow, W. G., "Notes on Fungi. I," in The Botanical Gazette, Vol. XIV, No. 8, August, 1889, p. 188.

12. **Bremia Lactucae** Regel.

On *Lactuca Canadensis* L.

1971, June 1, 1890, Manhattan; 1600, June 18, 1889, Manhattan.

14. **Peronosporae Arenariae** (Berk.) Tul. var. **macrospora** Farl.

On *Silene antirrhina* L.

1975, with abundant mature **OOSPORES**, on leaves, **APRIL** 21, 1890, Manhattan; 1938, with abundant mature oospores, April 27, 1890, Manhattan.

Both of these numbers were collected on seedling plants growing in a wheat field. The presence of oospores in these specimens now renders certain their identity with the variety *macrospora* of Farlow, since the oospores agree exactly with the description given by him in "Additions to the Peronosporeae of the United States," in Botanical Gazette, Vol. IX, No. 3, March, 1884, p. 38, No. 12*. In all the specimens both oospores and conidia were abundant.

16. **Peronospora Arthuri** Farlow.

On *Œnothera sinuata* L.

1977, April 6, 1890, Manhattan.

16.* **PERONOSPORA CALOTHECA** de Bary.

1858 PERONOSPORA CALOTHECA de Bary in Rabenhorst, Klotzschii herb. viv. myc., Edit. 2, Cent. VII, No. 673; in Botanische Zeitung, XVI Jahrg. 1858, S. 58; Rech. s. l. dévelop. quelq. champ. par., in Ann. Sci. Nat., 4e série t. XX. caher No. 1, p. 112, (p. 107 of the extract); No. 9, Pl. 13, fig. 4, Berk. & Br., Ann. N. H., No. 1454; Cooke, British Fungi, in Grevillea, vol. III, No. 28, June, 1875, p. 183; Frank, Die Krankheiten der Pflanzen S. 410; Schroeter, Die Pilze Schlesiens I, S. 241, No. 362 (Cohn, Krypt. Flora Schles. III Bd. I. Hälfte.); Berlese et De-Toni in Saccardo, Sylloge Fungorum, vol. VII, Pars I, p. 245, No. 817.

1863 PERONOSPORA GALII Fuckel, Fungi rhenani exsic. Fasc. I, No. 30.

1863 PERONOSPORA SHERARDIAE Fuckel, Fungi rhenani exsic. Fasc. I, No. 31.

Conidia and oospores on leaves of *Rubiaceae*, April.

On *Galium Aparene* L.

1939, with mature oospores, on leaves, April 27, 1890, Pottawatomie county, northwest of St. George.

This species found this spring for the first time within the State, was abundant on some seedling *Galium* growing along an old fence. The oospores were found in the oldest leaves attacked, and agreed very closely with the description and figures given by de Bary.

17. **Peronospora Oxybaphi** Ellis & Kellerman.

On *Oxybaphus nyctagineus* Sweet.

1985, May 8, 1890, Manhattan; 1986, May 26, 1890, Manhattan.

18. **Peronospora Corydalis** de Bary.

On *Corydalis aurea* Willd., var. *occidentalis* Engelm.

1980, on leaves, April 21, 1890, Manhattan; 1581, with mature oospores, on leaves, April 27, 1890, Manhattan; 1688, with abundant mature oospores, on leaves, stems and inflorescences, May 16, 1889, Manhattan; 1999, with abundant mature oospores, on leaves, **JUNE** 9, 1888, Manhattan.

19. **Peronospora parasitica** (Persoon) Fries.

On *Sisymbrium* sp.

1992, on leaves, April 6, 1890, Manhattan.

On *Lepidium intermedium* Gr.

1987, on leaves, April 4, 1890, Manhattan; 1988, on leaves, April 28, 1890, Manhattan; 1989, on leaves, May 8, 1890, Manhattan.

24. **Peronospora alta** Fuckel.

On *Plantago Rugelii* Decaisne.

1972, coll. M. Varney, May 26, 1890, Manhattan; 1973, June 1, 1890, Manhattan; 1974, with mature oospores, **OCTOBER** 25, 1890, Manhattan.

25. **Peronospora candida** Fuckel.

On *Audrosace occidentalis* Ph.

1979, with abundant mature oospores, April 6, 1890, Manhattan.

26. **Peronospora grisea** Unger.

On *Veronica peregrina* L.

1984, with mature **OOSPORES**, June 1, 1890, Manhattan.

28. **Peronospora Swinglei** Ellis & Kellerman.

On *Salvia lanceolata* Willd.

1976, on leaves and stems, **JULY** 3, 1887, Manhattan.

29. **Peronospora effusa** (Greville) Rabenhorst.

On *Chenopodium album* L., var. *viride.*

1982, **APRIL** 27, 1890, Pottawatomie county, northwest of St. George; 1983, coll. M. Varney, May 26, 1890, Manhattan.

30. **Peronospora Rumicis** Corda.

On *Polygonum dumetorum* L., var. *scandens* Gray.

1991, with mature **OOSPORES**, on leaves, **JUNE** 1, 1890, Manhattan; 1990, coll. M. Varney and W. T. Swingle, with mature oospores, on leaves, June 2, 1890, Manhattan.

This rather rare species was found this year in considerable quantity on plants growing in shady woods, on the old site of a creek-bed. The oospores were quite abundant in the oldest yellow or brown leaves, but could not be found on the bright green leaves bearing conidiaphores. The oospores are 30 to 40 μ diam., with a brown epispore which is very irregularly ridged or folded, giving the oospores a star-like appearance in optical section. The oogonia are shriveled and difficult to see clearly. The epispore varies in thickness from 2 to 10 μ.

31. **Peronospora Euphorbiae** Fuckel.

On *Euphorbia glyptosperma* Engelm.

1994, coll. W. T. Allen, with mature oospores, on leaves, August 5, 1890, Manhattan.

Prof. Byron D. Halsted says [1] "Peronospora Euphorbiae, Fckl., is a species which quickly disappears in times of drought." This summer has been a very dry one, and during a very dry time *Peronospora Euphorbiae* was collected in quantity on *Euphorbia glyptosperma* growing on some dry, sandy hills. At the same time a very little *Cystopus Portulacae* was observed on *Portulaca obracea* growing in a neighboring corn-field. Aside from these two species the Peronosporaceae had disappeared,

[1] Halstead, Byron D., Downy Mildews in a Dry Season, in Bull. from the Botanical Department of the State Agricultural College, Ames, Iowa, February, 1888, p. 98; Peronosporeae and Rainfall, in *Journal of Mycology*, vol. 5, No. 1, March, 1889, p. 9.

excepting *Cystopus candidus* in the oospore-bearing distortions on *Brassica nigra*. But the oospores, after once being formed (during May and June?), could, of course, endure any kind of weather. These facts would go to show that under some conditions at least *Peronospora Euphorbiae* should be classed as a drought-resisting species. It is an interesting fact that during dry or otherwise unfavorable times, the various species of Peronosporace disappear entirely from their rarer hosts and attack, to a lessened degree, only their most common hosts. For instance, here *Peronospora Euphorbiae* is found on *Euphorbia hypericifolia* only during favorable Peronospora weather, and then only in small quantity. During dry weather I have as yet failed entirely to find it on this host. These facts might indicate a closer adaptation of the Peronospora for some hosts than for others, and hence, under unfavorable conditions, only those hosts would be attacked to which the parasite was most perfectly adapted. Of course, in some cases, the habitat (on high, dry land for instance) of the supporting plant might hinder the spread of the parasite, although the parasite were perfectly adapted to its host.

32. **Peronospora sordida** Berkeley.

On *Scrophularia nodosa* L.

1993, June 2, 1890, Manhattan.

Including the additions given in this paper, there are now known from Kansas 33 species of Peronosporaceae, on 71 different host plants, entering the hybrid varieties of cultivated grape as 1 species. 70 of these host plants are dicotyledonous phanerogams, and 1 (Setaria) a monocotyledonous phanerogam. 31 species on 67 host plants occur within a radius of ten miles from Manhattan, Kansas.

ON THE GERMINATION OF INDIAN CORN AFTER IMMERSION IN HOT WATER.

BY W. A. KELLERMAN, PH. D.

Numerous trials were made in July and August to determine the germination of Indian corn after immersion for one-third of a minute to twenty minutes in water ranging in temperature from 56° C. (132.8° F.) to 88½° C. (199° F.).

The temperature of the water in the vessel was kept, during the immersion of the grain, at the desired temperature by addition of cooler or warmer water as required.

After immersion the grain was plunged into cold water in order to cool it rapidly. While in the vessel of hot or cold water, the wire basket containing the grain was given repeatedly a whirling and a plunging motion, so that every grain might surely be subjected to water of the same temperature the entire time of immersion.

After the above treatment the grain was at once planted, either in a Geneva tester kept indoors, or in the ground. The results of the germinations are given in the extended tabulation below.

The varieties of corn used were St. Charles and Normandy Giant (*white*), Leaming and Murdock's (*yellow*), Thoroughbred *Flint*, Mason's flour corn (*soft*), Shakers Early *Sweet* and *Pop* corn. The change from St. Charles to Normandy Giant, and from Leaming to Murdock's, was necessitated by insufficient quantity of the first variety in each case, but the germinative capacity was tested in each case and they were found to be identical. Therefore, the results are not vitiated by this enforced change.

The grains in the tester germinated in two or three days, but usually six or seven